

Amendments to the Specification:

Please replace paragraph [0001] with the following amended paragraph:

[0001] The invention relates to a system for the automatic application of self-adhesive protective film to vehicle bodies ~~according to the preamble of claim 1, as emerges~~ as disclosed, for example, ~~from~~in DE 198 09 515 A1, ~~which in the following text is cited as [1] for short.~~

Please add the following new heading before paragraph [0002]:

BACKGROUND

Please replace paragraph [0002] with the following amended paragraph:

[0002] It is primarily the horizontal body parts - three in conventional sedans - namely the hood, roof and rear panel, which are to be protected by having an appropriate piece of a self-adhesive protective film stuck over them for the transport of the new vehicle from the fabrication site to the vehicle dealer. The system disclosed ~~by [1]~~ in DE 198 09 515 A1 for the application of the protective transport film intrinsically represents a small production line comprising a plurality of workstations. Therein, the finally assembled vehicles standing on their own wheels and to be stuck are conveyed cyclically through the various stations of the application system; during an application of a piece of protective film, the vehicles are temporarily stopped.

Please replace paragraph [0003] with the following amended paragraph:

[0003] In order to be able to understand the present invention correctly, it is necessary to assume correct understanding of the mode of operation of the application system disclosed ~~by [1]~~ in DE 198 09 515 A1, for which reason this system is to be discussed in more detail first.

Please replace paragraph [0004] with the following amended paragraph:

[0004] In a first workstation of the application system according to ~~[1]~~ DE 198 09 515 A1, the supply rolls of the protective film are arranged to be stationary and centrally above the conveyor line with the roll axis located transversely with respect to the transport direction; the film is therefore drawn off the supply rolls in the transport direction. In this case, for each of the three aforementioned body parts, a separate supply roll is provided in each case, whose width measured in the axial direction corresponds to the length of the associated body part measured in

the body longitudinal direction. Each of the three supply rolls is arranged at a different height, so that a piece of film can be drawn off from each of the three rolls as required. The supply rolls are in each case dimensioned to be sufficiently large that they contain the film needed for at least one working shift.

Please replace paragraph [0008] with the following amended paragraph:

[0008] Since, in most cases, as stated, three horizontal body parts have to have protective film stuck over them, the procedure outlined has to be repeated three times, namely with the appropriate piece of film in each case on each of the three body parts of a vehicle. These application procedures to be carried out three times could be carried out one after another with a time offset by the same pair of opposed application robots, which would lead to a relatively long cycle time. In order to shorten the cycle time, the application system according to ~~document [1]~~ DE 198 09 515 A1 accordingly proposes two pairs of opposed application robots which operate approximately simultaneously; however, the respective piece of film still has to be picked up from the unwind station by the two pairs of robots with a time offset, for reasons of space and for reasons of accessibility. The third body part then has to have its application carried out by one of the two pairs of robots with a time offset in relation to the two first parts of the body to which applications were made simultaneously. In principle, it would also be conceivable to provide three pairs of opposed application robots in the application system, so that all three body parts could have simultaneous applications. However, this would presuppose a further application station for the third pair of robots and a separate, associated unwind station. The space required and the investment for this purpose are obviously not in a tolerable relationship with the gain in productivity, for which reason in ~~[1]~~ DE 198 09 515 A1 only two pairs of robots are provided in the application system.

Please replace paragraph [0009] with the following amended paragraph:

[0009] The system disclosed by ~~[1]~~ DE 198 09 515 A1 for protective film application therefore has a total of five industrial robots, which must all be capable of movement under computer control parallel to the conveying direction of the vehicles to be treated, to a certain extent as a seventh robot axis. The cycle time of the protective film application is determined by the time required for two application procedures to be carried out with a time offset, each of which

comprises drawing a perforated piece of film from the unwind station, re-orienting this piece of film in the transverse direction, aligning it with the associated body part, and the actual application of the piece of film. In the case of the simultaneous processing of two pieces of film, with regard to the time required it is also necessary to take into account the fact that the “fetching” of the two pieces of film from the unwind station can be carried out only with a time offset, for reasons of accessibility. Despite the relatively high investment for the application system, the productivity is therefore not particularly high.

Please add the following new heading before paragraph [0011]:

SUMMARY OF THE INVENTION

Please replace paragraph [0012] with the following amended paragraph:

[0012] ~~According to the invention, this object is achieved by the characterizing features of claim 1.~~—The solution according to the invention primarily concerns what is known as the system layout of the application system, that is to say features which refer to the system as a whole. The invention is first to be assessed briefly in the following text with regard to lower investment and operating costs and then with regard to the increase in productivity, before an exemplary embodiment is described in detail.

Please replace paragraph [0013] with the following amended paragraph:

[0013] The cause of saving a substantial part of the investment costs is the supply rolls integrated in the ~~robot~~ application tool for each of the pairs of robots. As a result, fetching and careful pivoting of a piece of film from a central, fixed unwind station is avoided and moving the application robots in the transport direction becomes dispensable. As a result of omitting the movement device of the application robots, these become quite considerably less expensive, since the movement devices are large parts to be fabricated with high accuracy and which are very expensive to produce. In addition, the supply rolls are very small and can be installed in magazines close to the ground; dispatch containers can be handled with conventional industrial trucks, for example fork stackers, and individual supply rolls can readily be handled manually. The roll change can be carried out automatically by the application robots, given a suitable construction of the roll magazine and the application tool. The small supply rolls can be

provided with inexpensive disposable cores and, because of their low weight, can readily be transported and stored horizontally. To this extent, logistical efforts loading the operating costs for the monitored return of expensive empty goods are not necessary. Because of the supply rolls integrated into the tools, the likewise quite costly bridge crane system for high loads, which was necessary in the prior art for loading the unwind station arranged high overhead with the heavy supply rolls, is also dispensed with. All in all, the investment and operating costs of the application system according to the invention are considerably lower than in the prior art on which it is based.

Please replace paragraph [0014] with the following amended paragraph:

[0014] Furthermore, the new application system permits higher productivity, but this is achieved by using a further pair of application robots as compared with the prior art. On account of the use of three pairs of application robots, all three body parts to be treated can be stuck simultaneously, which reduces the cycle time considerably as compared with the prior art. There, three pairs of - movable - application robots are used only at the expense of a further unwind station arranged overhead. Since the supply rolls are arranged decentrally, new pieces of film can be drawn off the rolls simultaneously, which has a beneficial effect on the cycle time. Despite the present readily possible use of a total of six - stationary - industrial robots, there is nevertheless no additional investment expense as compared with the prior art, even if the system illustrated in-[1] DE 198 09 515 A1 having a total of five industrial robots is used for the comparison. The one additional - stationary - industrial robot causes far lower investment costs than are saved by omitting other system components required in the prior art. It must certainly be admitted that the cycle time in the application system according to the invention is not determined solely by the application procedures running simultaneously but that the pieces of film also have to be provided with perforation lines within the cycle time, specifically before the application of the pieces of film, which is also carried out by the application robots. Perforation and application are therefore carried out with a time offset within the cycle time, which is determined by the time duration of the two procedures. In this connection, it is necessary to know that the perforation of the stretched-out pieces of film with the operating means proposed by the invention requires only a fraction of the time of the application of the film. Therefore,

despite time-offset perforation and application, a shortening of the cycle time as compared with the prior art with two application procedures within one cycle time is nevertheless achieved.

Please add the following new heading before paragraph [0015]:

BRIEF DESCRIPTION OF THE DRAWINGS

Please replace paragraph [0015] with the following amended paragraph:

[0015] ~~Expedient refinements of the invention can be gathered from the subclaims. Otherwise,~~
The invention will be explained further below by using an exemplary embodiment illustrated in the drawing, in which:

Please add the following new heading before paragraph [0021]:

DETAILED DESCRIPTION

Please replace paragraph [0023] with the following amended paragraph:

[0023] The application station 9 having only one pair of application robots 12a, b is provided for the treatment of the roof area 2 of the body 1, while the application station 10 is provided with two pairs of opposed application robots 13a, b; 14a, b for the application of a piece of film 24 in each case corresponding to the hood area 3 and the rear panel area 4, respectively. The roof area needs the largest piece of film and, accordingly, the largest application tools 18, 19 on the working arm 16 or on the wrist 17 of the robot 12a, b, which in turn requires most space when handling the piece of film 24 to be applied. For this reason, the two roof application robots 12a, b are advantageously arranged on their own in the workstation 9. By contrast, the two other body areas to be protected - hood 3 and rear panel 4 - need substantially smaller pieces of film and the robots accordingly need smaller ~~robot~~ application tools 18', 19' and 18'', 19'', respectively, and less room to move. In addition, these body areas are located far away from each other on the body, so that the two pairs of application robots cannot interfere with each other when working. For this reason, the two pairs of robots 13a, b and 14a, b for the treatment of hood and rear panel are arranged in a common application station - station 10.

Please replace paragraph [0026] with the following amended paragraph:

[0026] In one conceivable configuration of the application system, the supply rolls, including associated cutting device, could for example be arranged to be stationary above the respective pair of application robots in such a way that the non-adhesive side of the protective film points downward. In such a case, the ~~robot~~ application tools of both application robots would substantially only comprise a suction strip corresponding to the film width. For an application procedure, the robot arranged opposite the supply roll would draw a suitable piece of film off the supply roll, the appropriate suction strip gripping the film on the visible side pointing downward. The robot arranged on the same side as the supply roll would then pick up the other end of the piece of film, initially still connected to the film supply, likewise on the underside of the film. Finally, the piece of film would be cut off the film supply. Before said piece can be applied to the body, the piece of film would have to be pivoted through 180° about a horizontal transverse axis, so that the adhesive side of the protective film points downward.

Please replace paragraph [0027] with the following amended paragraph:

[0027] Such a configuration of the system, possible in principle, would certainly be more productive and cost-effective than the application system disclosed by [1] in DE 198 09 515 A1 but would still not be cost-optimal, since heavy supply rolls covering the need for a complete working shift and mounted at a great height would still have to be provided. Although, because of the lateral arrangement of the supply rolls, an expensive bridge crane system with a high loadbearing capacity would not be absolutely necessary; instead the rolls could also be lifted into the lateral mountings by means of conventional forklift trucks; for this purpose, the latter would have to be provided with specific equipment for the roll handling. Furthermore, stable and complicated cores consisting of steel, and transport and storage points for the heavy supply rolls would have to be provided and, in the empty state, would have to be returned to the film manufacturer whilst being monitored, that is to say with a great deal of logistical effort.

Please replace paragraph [0028] with the following amended paragraph:

[0028] In order to avoid this cost, in the exemplary embodiment illustrated the supply rolls 22, 22' and 22'' which are just being used are small and are in each case arranged directly in the associated ~~robot~~ application tool 18, 18', 18'' of one of the application robots 12a, 13a, 14a in

each case of a robot pair. Arranged in the ~~robot~~ application tool arranged on the wrist 17 of its working arm 16 is a holder 30 for a supply roll, which can be fixed by means of a ~~brake~~ fixing device 31 such as a break against film being drawn off, and also a cutting device 41. The respectively opposite application robot 12b; 13b; 14b of the pairs of robots substantially contains a suction strip 50 as ~~robot~~ application tool 19, 19', 19''.

Please replace paragraph [0029] with the following amended paragraph:

[0029] Of course, for reasons of weight, only relatively small supply rolls can be arranged within the application tool. One supply roll 22, 22', 22'' in each case expediently contains the film required for about 100 to 200 application procedures. In order nevertheless to permit long-lasting and automatic operation of the application robots, within the working space which can be reached by the working arm 16 of each application robot provided with a supply roll there is arranged a magazine 21, 21', 21'' for a large number of supply rolls 22, 22', 22''. In these roll magazines, the supply rolls are mounted and held in such a way that they can be transferred automatically into the ~~robot~~ application tool 18, 18', 18'' of the application robot. ~~Incidentally,~~ Each supply roll is provided with a core 23 that may be made of an ~~cheap~~ inexpensive material, such as hard paperboard or plastic, which can be used as a disposable core and, under certain circumstances, can be disposed of after use, at least if they are damaged. Return transport of satisfactory cores to the film manufacturer for reuse can take place, which would save disposal costs. For example, empty cores could be added from time to time to the delivery vehicles belonging to the film manufacturer for the empty return journey to the film manufacturer. For this purpose, only collection of the good cores is necessary but not monitored circulation of expensive and voluminous components.

Please replace paragraph [0030] with the following amended paragraph:

[0030] In fig. 3, the two application tools 18 and 19 of the pair of robots 12a, b are illustrated during the interaction in the phase of the start of the transfer of the free end of the film to the suction strip 50 of the application tool 19 of the robot 12b, which working phase is also shown in figure 2a. The application tools 18' and 19' and, respectively, 18'' and 19'' of the robots 13b and 14b are constructed in a completely analogous way; they differ in practice only in the working width of the ~~robot~~ application tools, which is matched to the respective width B' and

B'' of the supply roll 22' and 22''. The core tube of the supply roll 22 accommodated in the application tool is mounted in two axially opposite roll holders 30 within the tool. The roll holders are guided on carriages 46 such that they can move in the axial direction of the supply roll and are provided with an appropriate displacement drive and with a fixing device; however, the latter are not illustrated by drawing. Rotatably mounted in the roll holders in each case is a plug-in journal, which can be introduced axially into the core tube 23 of the supply roll and pulled out of the latter, it being possible for each plug-in journal to be braced with the core tube such that it is secure against rotation when introduced, so that no relative rotation between core tube and plug-in journal is possible. The supply roll accommodated between the plug-in journals is mounted within the application tool via the plug-in journals such that it can rotate. At least one of the plug-in journals is provided with a fixing device 31, for example in the form of a brake disk on the journal side and a brake caliper on the frame side, with which the supply roll can be fixed against film being drawn off.

Please replace paragraph [0033] with the following amended paragraph:

[0033] Arranged within the application tool 18 is a suction strip 35 which extends over the width of the supply roll and is aligned parallel to the latter, whose underside contacts the non-adhesive upper side of the film in the run of the film drawn off the supply roll and is air-permeable on this side. The suction strip can have a vacuum applied to it as required - in order to hold the film fast - or else vented again - in order to release it. The suction strip is fixed to a carriage 36, which can be displaced on the carriage guide 37 oriented transversely with respect to the supply roll. The carriage is urged by a return spring 44 into a normal position, determined by a stop 45, but from which it can be expelled, as figure 3 shows.

Please replace paragraph [0041] with the following amended paragraph:

[0041] The edges of the pieces of protective film located at the front in the direction of travel are also subjected to the slipstream during the journey with the film-protected vehicle and could detach from the body under certain circumstances because of a strong flow around them. In order to avoid this risk, also while maintaining a comparatively low adhesive force of the self-adhesive protective film - which is certainly intended to be able to be released easily from the body surface and without leaving any residue when it is supplied to the vehicle dealer - the front

edges of the pieces of protective film are secured by having a self-adhesive strip with a higher adhesion force stuck over them. These edge securing strips, as they are known, can readily be pulled off the body surface again when required, because of their lower width, particularly since they adhere to the protective film to some extent. In order to be able to carry out the application of these edge securing strips automatically as well, a device 51 for applying a narrow self-adhesive edge securing tape is integrated into the ~~robot~~ application tools 19', 19'', those having the suction strip 50. By using said robot, the edges of the film located at the front in the direction of travel of the body 1 can be stuck over automatically in the roof region 2 and hood region 3.

Please amend the heading on top of page 18 with the following amended heading:

~~Patent claims~~ WHAT IS CLAIMED IS: